

# NASA TECH BRIEF

## John F. Kennedy Space Center



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### Start/Stop Switches for Testing Detonation Velocity of Explosives

#### The problem:

Ordnance-initiated start/stop switches are used in measuring detonation velocities of various explosives. The switches are manufactured by hand. This process is costly and time consuming, and the product is not always uniform in quality.

#### The solution:

The switches can be manufactured using a printed-circuit process. The process is faster, and the product is less costly and more uniform in quality.

#### How it's done:

A newly developed switch is shown in Figure 1. It includes two pairs of conductor strips marked "primary start" and "secondary start." The two pairs are used for improved reliability. Both are activated by the explosive, and if one fails, the other still turns on to connect the circuit. A stop switch is constructed similarly.

The conductor strips are mounted on a flexible printed-circuit (PC) board. Each pair is made from a 0.125-in. (3.2-mm) conductor forming a double direct overlay. The strips within each pair are separated by an airgap of approximately 0.005 in. (0.127 mm). The strips are connected to the electronic equipment with a four-conductor ribbon wire. The other dimensions are shown in the figure. These can be made smaller using 0.0625-in. (1.59-mm) PC conductors.

For a test the switches are connected to the electronic equipment as shown in Figure 2. They are set a measured distance apart, and a train of explosive material is placed over them as shown.

The test is initiated by detonating the explosive train with the firing cable. As the explosive burns over the start switch, the switch closes, activating the pulse generator to trigger the electronic counter. A short time later, the explosive burns over the stop switch, triggering the pulse generator to stop the count.

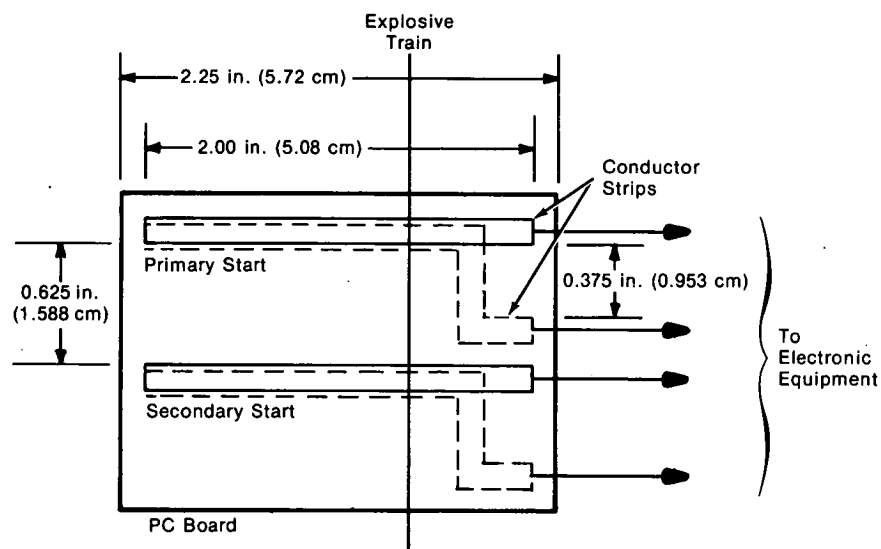


Figure 1. Typical Switch Configuration

(continued overleaf)

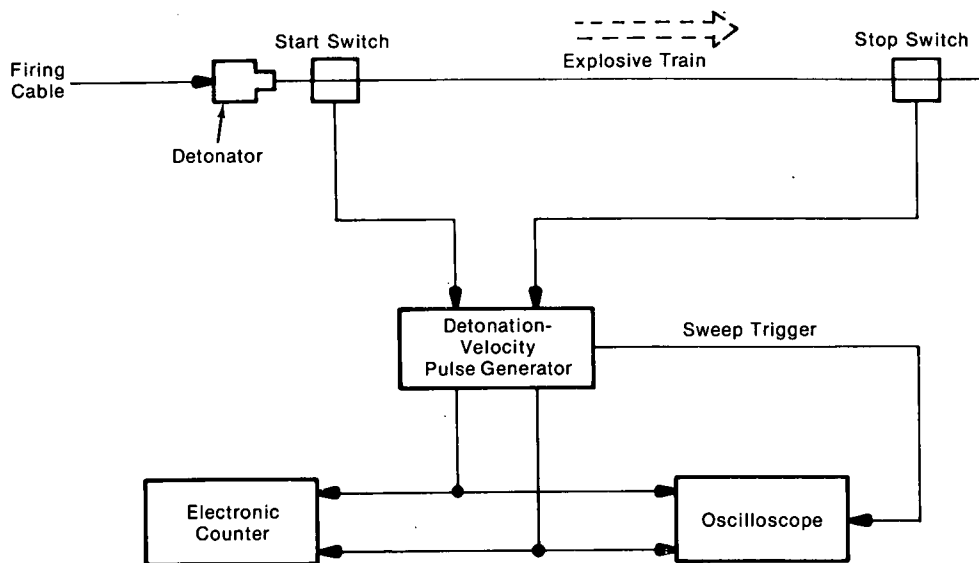


Figure 2. System for Determining Detonation Velocity of Explosives

Detonation velocity of the explosive is computed by dividing the distance between the switches by the recorded burn time.

Special Bakelite switch holders have also been constructed. These are shaped to hold the switches during the testing of confined detonation charges.

**Patent status:**

NASA has decided not to apply for a patent.

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**Note:**

Requests for further information may be directed to:

Technology Utilization Officer  
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Reference: TSP75-10255

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